CLAIMS

1. An inline optical amplifier station for an optical system transporting a bidirectional optical signal comprising:

A first optical coupler/decoupler for separating an unamplified eastbound signal from a first bidirectional signal and for combining an amplified westbound signal into the first bidirectional signal;

A second optical coupler/decoupler for separating an unamplified westbound signal from a second bidirectional signal and for combining an amplified eastbound signal into the second bidirectional signal;

A first variable optical attenuator connected to the unamplified eastbound signal and to an optical coupler;

A second variable optical attenuator connected to the unamplified westbound signal and to the optical coupler;

The optical coupler combining the unamplified eastbound signal with the unamplified westbound signal into a combined unamplified signal;

The optical coupler operatively connected to an optical amplifier;

The optical amplifier converting the combined unamplified signal into a combined amplified signal; and

The optical amplifier operatively connected to an optical decoupler decoupling the combined amplified signal into the amplified eastbound signal and the amplified westbound signal.

2. The inline optical amplifier station of claim 1 wherein the optical amplifier comprises a multistage amplifier.

3. The inline optical amplifier station of claim 1 wherein the optical amplifier further comprises a first stage producing an intermediate combined amplified signal connected to a second stage producing the combined amplified signal.

4. The inline optical amplifier station of claim 3 wherein a third variable optical attenuator is operatively connected between the first stage and the second stage.

5. The inline optical amplifier station of claim 3 wherein a dispersion compensator is operatively connected between the first stage and the second stage.

6. The inline optical amplifier station of claim 3 wherein a dispersion compensator is operatively connected between the first stage and the second stage.

7. The inline optical amplifier station of claim 1 wherein the amplified eastbound signal and the amplified westbound signals comprise different wavelengths in two separate bands.

8. The inline optical amplifier station of claim 1 wherein the amplified eastbound signal and the amplified westbound signal are interleaved on separate channels.

9. The inline optical amplifier station of claim 1 wherein a third bidirectional signal is coupled with the first bidirectional signal in a third optical coupler to produce a fourth bidirectional signal.

10. The inline optical amplifier station of claim 8 wherein the third bidirectional signal includes an optical service channel.

11. The inline optical amplifier station of claim 9 wherein a fifth bidirectional signal is combined with the second bidirectional signal in a fourth optical coupler to produce a sixth bidirectional signal.

12. The inline optical amplifier station of claim 10 wherein the control channel is in a separate wavelength range from the amplified eastbound signal and the amplified westbound signal.

13. The inline optical amplifier of claim 9 wherein the third bi-directional signal includes an optical service channel.

14. The inline optical amplifier station of claim 13 wherein the control channel is in a separate wavelength range from both the amplified eastbound signal and the amplified westbound signal.

15. The inline optical amplifier station of claim 9 further comprising a westbound transmitter providing a westbound transmitted signal.

16. The inline optical amplifier station of claim 13 further comprising an eastbound receiver for receiving an eastbound received signal.

17. The inline optical amplifier station of claim 16 wherein the westbound transmitted signal is coupled into the third bidirectional signal and the eastbound received signal is decoupled from the third bidirectional signal by a third optical coupler/decoupler.

18. The inline optical amplifier station of claim 17 wherein the first bidirectional signal is coupled with the third bidirectional signal in a third optical coupler to product a fourth bidirectional signal.

19. The inline optical amplifier station of claim 11 further comprising an eastbound transmitter producing an eastbound transmitted signal.

20. The inline optical amplifier station of claim 19 further comprising a westbound receiver for receiving a westbound received signal.

21. The inline optical amplifier station of claim 20 wherein the eastbound transmitted signal is coupled into the fifth bidirectional signal and the westbound received signal is decoupled from the fifth bidirectional signal by a fourth optical coupler/decoupler.

22. The inline optical amplifier station of claim 21 wherein the fifth bidirectional signal and the second bidirectional signal are coupled by a fourth optical coupler into a sixth bidirectional signal.

23. The inline optical amplifier station of claim 4 further comprising:

An optical decoupler operatively connected to the third variable optical attenuator decoupling the intermediate combined amplified signal into a westbound uncompensated signal and an eastbound uncompensated signal;

A first dispersion compensation module operatively connected to the optical decoupler for compensating the eastbound uncompensated signal into an eastbound compensated signal;

A second dispersion compensation module operatively connected to the optical decoupler for compensating the westbound uncompensated signal into a westbound compensated signal; and

An optical coupler operatively connected to the first dispersion compensated module and the second dispersion compensation module for coupling the eastbound compensation signal and the westbound compensated signal into the intermediate combined amplified signal.

24. The inline optical amplifier station of claim 1 wherein the amplified signal is further modified by an optical element before being decoupled.

25. The inline optical amplifier station of claim 24 wherein the optical element is an optical add/drop multiplexer.

26. The inline optical amplifier station of claim 24 wherein the optical element is a dynamic gain equalizer.

27. The inline optical amplifier station of claim 24 wherein the optical element is a second optical amplifier.

28. The inline optical amplifier station of claim 24 wherein the optical element is a dynamic band equalizer and a second optical amplifier.

29. The inline optical amplifier station of claim 24 wherein the optical element is an optical add/drop multiplexer and a second optical amplifier.

30. The inline optical amplifier station of claim 1 wherein the first variable optical attenuator and the second variable optical attenuator are adjusted to equalize the power of the unamplified eastbound signal with respect to the unamplified westbound signal.

31. A method for amplifying an eastbound signal and a westbound signal in a single fiber optical transport system comprising the steps of:

isolating an unamplified eastbound signal;

isolating an unamplified westbound signal;

power matching the unamplified eastbound signal and the unamplified westbound signal;

combining the power matched signals;

amplifying the power matched signals;

isolating an amplified eastbound signal; and

isolating an amplified westbound signal.

32. The method of claim 31 wherein the step of amplifying further comprises compensating for dispersion.

33. The method of claim 3 wherein the step of amplifying further comprises the step of attenuation of the power matched signals.

34. The method of claim 32 wherein the step of compensation for dispersion further comprise the steps of:

isolating an eastbound power matched signal;

isolating a westbound power matched signal;

compensating for the dispersion in the eastbound power matched signal;

compensating for the dispersion in the westbound power matched signal; and

recombining the eastbound power matched signal and the westbound power matched signal.

35. In an A-Z/Z-A bi-directional optical transport system having segments comprising a plurality of ordered spans separated by and connected to a corresponding series of ordered bi-directional DCMs and terminated by a first and second co-directional DCM having A-Z and Z-A compensators, a method of correcting for the dispersion of the spans comprising the steps of:

A. Adjusting each but the last of the co-directional DCMs to compensate for the dispersion of the corresponding previous span;

B. Adjusting the last co-directional DCM to compensate for the dispersion of the corresponding previous span, plus the dispersion of the corresponding subsequent span, minus the average dispersion of all the spans;

C. Adjusting the A-Z compensator of the second bi-directional DCM to compensate for the dispersion of the corresponding previous span; and

D. Adjusting the Z-A compensator of the first bi-directional DCM to compensate for the average of the bi-directional DCMs, plus the average dispersion of all the spans.

36. The method of claim 35 wherein:

Step A further comprises adjusting all DCMs to compensate for a specified amount of per-span dispersion under-compensation; and

Step A further comprises adjusting all DCMs to compensate for a calculated amount of dispersion "carry-over."

37. The method of claim 36 wherein the per-span dispersion under-compensation value is between 0 ps/nm and 100 ps/nm.

38. The method of claim35 wherein the optical transport system conducts wavelengths in the C band range.

39. The method of claim35 wherein the optical transport system conducts wavelengths in the L band range.

40. In a bi-directional optical transport system consisting of segments having a series of ordered spans separated by and connected to a corresponding series of ordered bi-directional DCMs and terminated at a first and second co-directional DCM each having an A-Z and Z-A compensator, a method of correcting for the dispersion of the spans comprising the steps of:

A. Adjusting each but the last of the co-directional DCMs and the A-Z compensator of the second bi-directional DCM according to the following equation:

$$D_{comp} = D_{N-1} + CO_{N-1} - D_{UC}$$

Where:

D_{comp} is the dispersion value to be compensated;

D_{N-1} is the dispersion value of the previous span;

D_{UC} is the per-span dispersion under-compensation; and

CO_{N-1} is the carry over dispersion value of the previous span;

B. Adjusting the compensation of the last co-directional DCM according to the equation:

$$D_{comp}' = (D_{N-1}' + D_N' - \frac{1}{N}\sum_{i=1}^{N} D_i) + CO_{N-1}'$$

Where:

D_{comp}' is the dispersion value to be compensated;

D_{N-1}' is the dispersion value of the previous span;

CO_{N-1}' is the carry over dispersion value of the previous span;

N is the number of ordered spans in the segment;

D_i is the dispersion value of each ordered span in the segment; and

C. Adjusting the compensation of the Z-A compensator of the first bi-directional DCM according to the equation:

$$D_{comp}'' = \sum_{i=1}^{N_1} D_N + \sum_{i=1}^{N} D_{compN} + CO_{N+1}$$

Where:

D_{comp}'' is the dispersion value to be compensated;

D_1 is the dispersion compensation value of the A-Z compensator of the first bi-directional DCM;

D_2 through D_N are the dispersion compensation values of each co-directional DCM;

D_{compN} is the dispersion of each span of the plurality; and

CO_{N+1} is the carry over from the co-directional DCM following to the last span of the segment.

41. The method of claim 40 wherein the carry over dispersion value of the second to last span is calculated according to the following equation:

$$CO_{N-1}'' = D_{N-1}'' + D_{comp}' + D_{req}$$

Where:

CO_{N-1}'' is the carry over from the previous span;

D_{N-1}'' is the dispersion value of the previous span;

D_{comp}' is the dispersion value compensated; and

D_{req} is the dispersion compensation value required to bring the dispersion of the second to last span to zero.

42. The method of claim 41 wherein the value of CO_{N-1} is not greater than 200 ps/nm.

43. The method of claim 41 wherein the value of CO_{N-1} is not greater than 100 ps/nm.

44. In an A-Z/Z-A bi-directional optical transport system comprising ordered spans separated by and connected to a corresponding series of ordered bi-directional DCMs and terminated by a first and second co-directional DCM having A-Z and Z-A compensators, a method of correcting for the dispersion of the spans comprising the steps of:

A. Adjusting each but the co-directional DCMs to compensate for the dispersion of the corresponding previous span;

B. Adjusting the last co-directional DCM to compensate for the dispersion of the corresponding previous span, plus the dispersion of the corresponding subsequent span, minus the average dispersion of all the spans;

C. Adjusting the A-Z compensator of the second bi-directional DCM to compensate for the dispersion of the corresponding previous span; and

D. Adjusting the Z-A compensator of the first bi-directional DCM to compensate for the average of the bi-directional DCMs, plus the average dispersion of all the spans.

45. The method of claim 44 wherein:

Step A further comprises adjusting all DCMs to compensate for a specified amount of per-span dispersion under-compensation; and

Step A further comprises adjusting all DCMs to compensate for a calculated amount of dispersion "carry-over."

46. The method of claim 45 wherein the per-span dispersion under-compensation value is between 0 ps/nm and 100 ps/nm.

47. The method of claim 44 wherein the optical transport system conducts wavelengths in the C band range.

48. The method of claim 44 wherein the optical transport system conducts wavelengths in the L band range.